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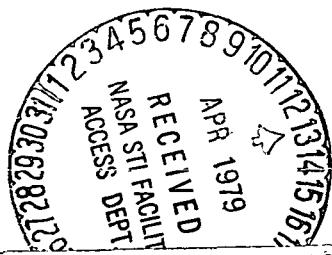
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SATELLITES CUT INDUSTRY, GOVERNMENT COSTS

Satellite observations of the Earth's atmosphere and surface are saving industries and government agencies at least \$172 million a year and perhaps many times that amount, a government analysis has suggested.

The findings were based on the reported use of information provided by geosynchronous and polar-orbiting satellites built and launched by NASA throughout the 1970s for the National Oceanic and Atmospheric Administration (NOAA).

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NOAA's GOES (geostationary) and Tiros class (polar-orbiting) spacecraft make up the two meteorological satellite systems that were studied by W. John Hussey and E. Larry Heacock of NOAA's National Environmental Satellite Service. Their analysis confined itself to nine activities in which annual savings could be estimated with some degree of confidence.

The agricultural industry -- especially Florida citrus growers -- may be the biggest beneficiary of savings from spacecraft. But use of satellite data (principally imagery) also can produce large savings for marine shipping and fisheries.

In Florida, imagery from a NOAA geosynchronous satellite is computer-processed to provide a temperature map every 30 minutes that can show the southward progress of crop-killing frost during winter nights. NASA, NOAA and the University of Florida are participating in this NASA-supported activity. By keeping track of the surface temperature pictures and using a computerized prediction scheme, the NOAA forecasters provide information which allows the citrus growers to decide when or if they should start the costly effort of heating their groves (\$833,000 per hour for fuel statewide).

Estimating that an hour and a half of heating protection per cold night are saved, and that 35 to 40 nights in Florida are cold during a typical winter, the study concludes that the potential for annual savings to Florida citrus farmers is \$45 million.

The Hawaiian sugar cane industry also uses satellite data in its crop management, and the Waialua Sugar Co. estimates a \$1 million in savings a year through use of satellite weather information for deciding when to burn sugar-cane fields before harvesting the crop.

As for other agricultural savings, the authors cited a 1973 NASA-funded study conducted by the Space Science and Engineering Center of the University of Wisconsin, which concluded that improved weather information and forecasting could have saved crop growers and processors \$74 million in 1971. Short-term forecasts are of particular value for crops that yield perishable products and require precise production techniques.

Before the availability of satellite data, the Great Lakes were usually closed to shipping for about two months each winter because of ice.

After aircraft-carried, side-looking radar and satellite data showing ice location became available two years ago, however, the 1976-77 season was extended by a month. During the 1977-78 season, shipping on the lakes never came to a complete halt, due in part to the improved ice information available. The study estimates the total cost benefit at about \$35 million during the 1977-78 winter.

Gulf of Mexico and Atlantic Coast shipping interests also realize savings by using satellite data to locate the ever-changing positions of the Gulf Stream and the Gulf Loop Current. In 1975, seven EXXON Corp. oil tankers used satellite data to ride the northbound currents of the Gulf Stream axis on northward transits, and to avoid the current on southward trips. The EXXON study indicated that the use of this satellite data for navigation has demonstrated potential annual fuel savings for the total fleet of 15 EXXON tankers of about \$360,000. The oil company now is using satellite information to help guide all of its vessels navigating along the east coast.

For the last three years, fishermen in the Pacific Ocean have been using satellite-derived information on the location of thermal boundaries in the ocean where salmon and albacore tend to congregate because of the high nutrient levels of the waters.

The combination of fuel saving and "additional catch advantage" afforded by the satellite infrared data has an estimated annual benefit of \$2,440,000.

Among Federal agencies, the Air Force and the Coast Guard have the highest annual savings attributable to satellite data, according to the NOAA report. The U.S. Air Force Aerospace Rescue and Recovery Service was able to reduce search and rescue missions flown by C-130 aircraft -- at \$995 an hour -- by 7,000 hours in both 1976 and 1977 because of satellite data, an annual savings of almost \$7 million. Satellite pictures showing bad weather conditions at the time missing aircraft were last heard from are used by the California Civil Air Patrol (CAP) to permit searchers to focus their efforts in those areas, thus reducing by as much as 60 per cent the average number of hours flown per rescue mission. The California CAP estimates annual fuel savings of \$344,000.

The Coast Guard's International Ice Patrol realizes cost reductions of about \$5 million a year in savings of aircraft flight hours and related costs because of satellite ice analysis, which aids planning and locating areas where visual reconnaissance missions can be flown with greatest efficiency.

Also benefiting from polar satellite imagery of ice is the U.S. Military Sea Lift Command which estimates savings of \$8,000 per day for every day of operations in routing its ships through Arctic waters.

In addition to viewing ice, satellites also can "see" the extent of snow cover. This capability has reduced by \$100,000 a year the cost of mapping snow cover in the Sierra Nevada river basins, an activity of vital importance to water resource and flood control managers previously dependent upon aircraft overflights.

The cost of airplane reconnaissance of hurricanes in mid-ocean regions also has been slashed dramatically -- by about \$1.8 million a year -- through use of satellite images to detect and monitor the growth and movement of the storms. An even greater saving may be realized because satellites let weathermen be more precise in pinpointing the exact location of a hurricane at sea. This can permit a narrowing of coastal areas that must come under a hurricane warning -- notification that an offshore hurricane may make landfall in the vicinity. When such warnings are issued by the National Hurricane Center for a typical Gulf of Mexico hurricane, about 300 nautical miles of coastal area are affected at a cost of about \$25.1 million including losses due to temporarily curtailed production.

More precise location of an offshore storm, which results in a reduction of even five per cent in the coastal warning area, would mean annual savings to the local economy of about \$2.5 million.

The NOAA report points out that other important activities made possible by satellite-provided information, such as local and global weather forecasting, do not allow for easy computation of dollar savings or of cost benefit. But the value, the authors believe, is in the "many billions of dollars." And the saving of life by improved disaster warnings of hurricanes, severe thunderstorms and heavy rainfall or snowmelt is beyond dollar value and altogether impossible to quantify.

The report adds: "The advent of satellites is perhaps the greatest significant advance in routine environmental monitoring that has been developed in history... contributing towards the savings of lives and property from natural disasters and improving the efficiency of the national economy."

NASA plans the launch of another weather satellite for NOAA next month from NASA's Western Test Range in California.

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